

## WHAT IS CLAIMED IS

1. A perfusion incubator, for culturing living cells, comprising:  
a medium supply;  
at least one well assembly with a well having an upper portion and a  
5 lower portion; and  
a peristaltic pump,

where each well assembly includes a medium inlet and a medium outlet,  
each medium outlet is positioned above the medium inlet, and the medium inlet is  
connected to the medium supply via the peristaltic pump.

10 2. A perfusion incubator as in Claim 1, further comprising an  
illumination device so that the lower portion of the well assembly can be observed  
by means of a microscope.

3. A perfusion incubator as in Claim 2, further comprising a  
microscope mount associated with the perfusion incubator.

15 4. A perfusion incubator as in Claim 1, where each well includes a  
means to provide a flow path from the medium inlet to the medium outlet within  
the well so that medium flow is tangential to the lower portion of the well.

20 5. A perfusion incubator as in Claim 1, where each medium inlet is  
positioned so as to allow a tangential entry of medium to the well at a mid point in  
the well, where the flow of medium in the well is formed by this construction into  
a vortex.

6. A perfusion incubator as in Claim 1, where each well has a stepped  
side wall defining an upper chamber and a smaller diameter lower chamber.

25 7. A perfusion incubator as in Claim 6, where each well has a lid that  
extends partially into the upper chamber.

8. A perfusion incubator as in Claim 7, where each lid is made of a substantially transparent material.

9. A perfusion incubator as in Claim 1, where at least a portion of the well assembly is made from a substantially transparent material.

5 10. A perfusion incubator as in Claim 1, where the peristaltic pump provides a flow rate of medium through each well of from 1 microlitre per hour to 10,000 microlitres per hour.

10 11. A perfusion incubator as in Claim 1, further comprising a medium conditioning unit, where the medium conditioning unit includes means to regulate the temperature of a medium and means to regulate the pH of the medium.

12. A perfusion incubator as in Claim 11, where the means to regulate the temperature of the medium is operated at a temperature of from 0.05° to 1.5° C above the operating temperature of a well assembly.

15 13. A perfusion incubator as in Claim 11, where the means to regulate the pH of the medium includes means to diffuse a gas into the medium.

14. A perfusion incubator as in Claim 11, where at least part of the well assembly is formed from a silicone elastomeric material and at least part of the well is surrounded by a lumen in the well assembly into which a gas is supplied.

20 15. A perfusion incubator as in Claim 1, where at least a portion of the medium inlet tube is formed from a silicone elastomeric material and at least a portion of the medium inlet tube formed from the silicone elastomeric material is surrounded by a jacket into which a gas is provided, where at least a portion of the gas diffuses through the medium inlet tube and into the medium.

16. A perfusion incubator well assembly comprising:  
a body, the body being formed from a material through which a gas  
can diffuse;  
at least one well in the body, the at least one well having a stepped  
side wall defining an upper chamber and a smaller diameter lower chamber;  
a medium inlet to the at least one well;  
a medium outlet from the at least one well, where the medium inlet  
is positioned to allow tangential entry of medium to the at least one well at a lower  
portion of the upper chamber, and the medium outlet is positioned above the  
medium inlet; and  
a lumen in the body, where the lumen provides a path for a gas to  
diffuse into the at least one well.

17. A perfusion incubator well assembly as in claim 16, where the  
lumen is open to a base of the well assembly.

18. A perfusion incubator well assembly as in claim 16, where a  
silicone elastomeric material forms at least a portion of the body of the well  
assembly.

19. A perfusion incubator well assembly as in claim 16, further  
comprising a lid that extends partially into the upper chamber, where the lid is  
made of a substantially transparent material.

20. A perfusion incubator well assembly comprising:  
a body that includes at least one well, where a material through  
which a gas can diffuse forms at least a portion of the body;  
a medium inlet to the at least one well;  
a medium outlet from the at least one well, where the medium inlet  
is positioned to allow tangential entry of medium to the at least one well at a lower  
portion of the upper chamber, and the medium outlet is positioned above the  
medium inlet.

21. A perfusion incubator well assembly as in claim 20, where a silicone elastomeric material forms the body of the well assembly.

22. A perfusion incubator well assembly as in claim 20, where the lid is a substantially transparent material.

5 23. A perfusion incubator well assembly as in claim 20, where the at least one well includes a stepped side wall defining an upper chamber and a smaller diameter lower chamber;

a medium inlet to the at least one well and a medium outlet from the at least one well, where the medium inlet is positioned to allow tangential entry of the medium to the at least one well at a lower portion of the upper chamber, and the medium outlet is positioned above the medium inlet; and

10 a lumen in the body, the lumen adapted to provide a path for a gas to diffuse into the at least one well.

24. A perfusion incubator comprising:

15 at least one well assembly;

a peristaltic pump; and

a medium inlet tube, the inlet tube providing fluid communication between the peristaltic pump and the at least one well assembly, where at least a portion of the medium inlet tube is formed from a material through which a gas can diffuse,

20 and at least a portion of the medium inlet tube formed from the material through which a gas can diffuse is surrounded by a jacket into which a gas is provided, where at least a portion of the gas diffuses through the medium inlet tube and into the medium.

25. A perfusion incubator as in Claim 24, where the at least one well further comprises:

a medium inlet in fluid communication with the medium inlet tube, where the medium inlet is positioned at a mid point in a well of the at least one well assembly; and

a medium outlet, the medium outlet positioned above the medium inlet.

26. A perfusion incubator as in claim 24, where the at least one well assembly has at least one well having a stepped side wall defining an upper chamber and a smaller diameter lower chamber.

27. A perfusion incubator as in claim 26, where an embryo resides in the smaller diameter lower chamber.